Tooway antenna controller

User Manual

Content:

1. System overview
1.1 Settings overview .
1.1.1 Offset settings.
1.1.2 Limits settings.
1.1.3 Motors settings.
1.1.4 Satellite settings.
1.1.5 Ip setup.
1.1.6 Backup settings.
1.2 Maintenance overview.
1.2.1 Firmware update.
1.2.2. Restart.
1.2.3 System status.
1.3 Auto and manual motion controls overview.
1.3.1 Manual motion controls.
1.3.4 Auto motions controls.
2. Antenna controller unit usage.
2.1 Offset settings adjustment
2.2 Limits settings adjustment
2.3 Inclinometer calibration
2.4 Compass calibration
2.5 Satellite searching

1. System overview

This chapter make overview of system settings, controls and indicators.

1.1 Settings overview

1.1.1 Offset settings

For open offset settings page click **Settings->Offset settings**. Using offset settings page user can set azimut local and real angle, elevation local and real angle, calibrate compass and inclinometer, check or set gps coordinates.

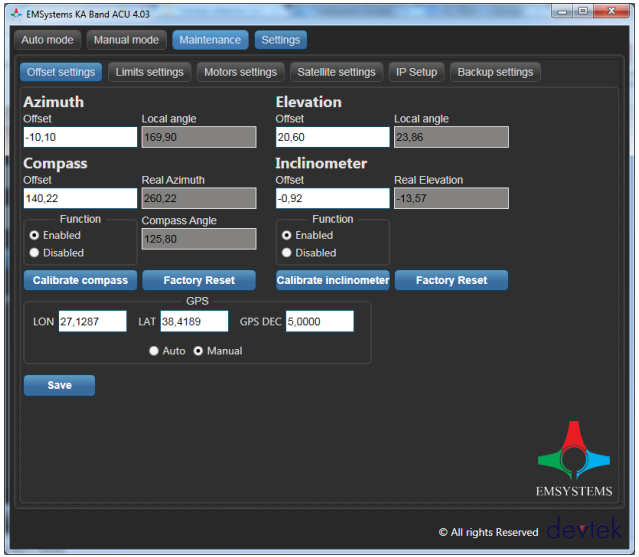


Figure 1.1.1.1 - Offset settings page

For change local angle of azimuth or elevation user must change fields **offset**.

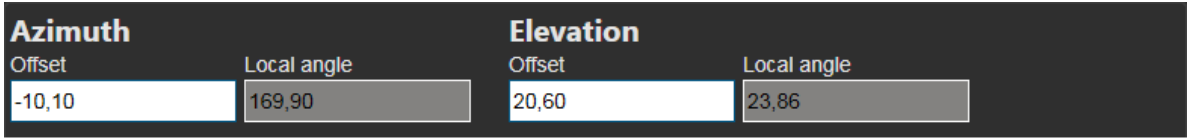


Figure 1.1.1.2 - Azimuth and elevation local angle

On **azimut real angle** give affects **azimuth local angle**, **compass angle** and **compass offset**. From compass system receive angle, than using this angle and azimuth local angle and compass offset, system calculate real azimuth angle. Compass angle user can see in the **Compass Angle** field. For adjust **real azimuth** user must change **compass offset**.

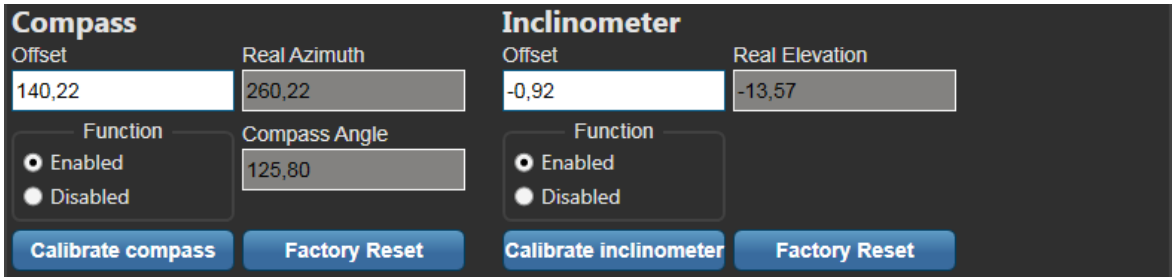


Figure 1.1.1.2 - Azimuth and elevation real angles

Inclinometer measure angle of antenna declination. System receive declination angle from inclinometer and calculate **real elevation angle** using **inclinometer angle, local elevation angle and inclinometer offset**. For adjust **real elevation angle** user must change **inclinometer offset**.

Calibrate compass and **Calibrate inclinometer** buttons use for start procedure of calibration compass and inclinometer angles. This procedure will be discussed in the next section. Buttons **factory reset** using for reset calibration procedure result and use inclinometer and compass without calibration offsets.

Function of compass and inclinometer (Enabled and Disabled) - must be always **Enabled**.

Gps Auto/Manual use for select **GPS mode**. **Auto** mean than in system we use gps module and we will receive coordinates from this gps module. Manual mean than we don't have gps module in the system and in this case user can insert coordinates manually.

After change any settings user must press button **save** for apply new settings in the system.

Figure 1.1.1.2 - Gps settings

1.1.2 Limit settings

For open **Limit settings** page click **Settings->Limits settings**. Using limits settings user can set **min and max angle of azimuth and elevation rotation**, **searching ranges** and **satellite signal level**.

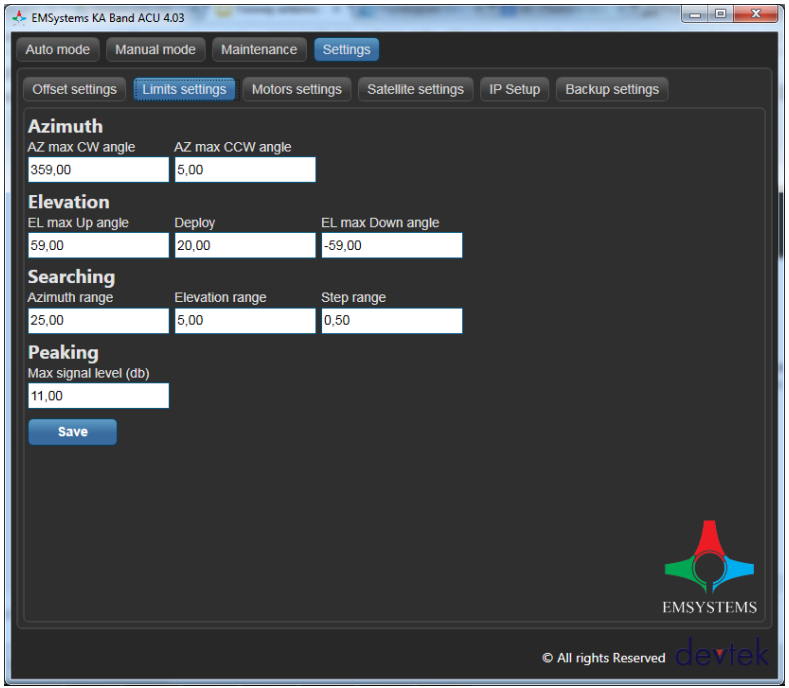


Figure 1.1.2.1 - Limit settings page

AZ max CW angle - maximum angle of clockwise azimuth antenna rotation. Must be low or equal to 360 degrees.
AZ max CCW angle - maximum angle of counter clockwise azimuth antenna rotation. Must be more or equal to 0 degrees.

Figure 1.1.2.2 - Azimuth CW and CCW angle

El max Up angle - maximum angle of up elevation antenna rotation. Must be about 60-65 degrees.
El max Down angle - maximum angle of down elevation antenna rotation. Must be about (-60)-(-65) degrees.
Deploy - minimum elevation angle when azimuth can start rotate freely. When Elevation angle low then deploy angle azimutt can't rotation. It is protection to not damage mechanics part of antenna.

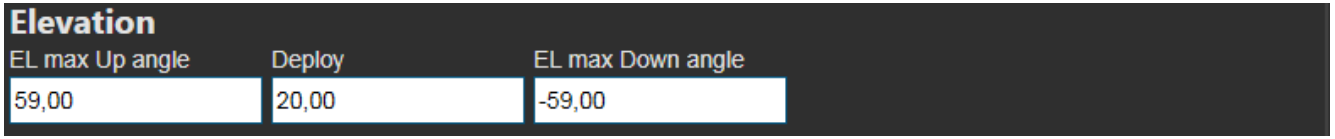


Figure 1.1.2.3 - Elevation limits angles

According **Searching range** working searching mechanism.
Azimut range - azimuth searching range. For example, on the figure 1.1.2.3 azimut range is 25 degrees. It mean than antenna controller will rotate azimut during searching on Azimut range*2 = 25*2=50 degrees. For stable and faster result of searching azimuth range must be about 20-30 degrees.
Elevation range and step range determinate rotation of elevation during searching mechanism. For stable and faster result of searching, elevation range must be about 5 degrees and step range must be about 0.5 degrees.

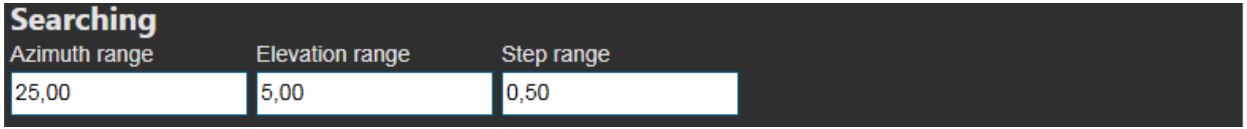


Figure 1.1.2.3 - Searching ranges

Max signal level(db) use for peaking mechanism. After find satellite, start peaking procedure. Peaking procedure make little rotation of azimuth and elevation for find best signal from satellite. If after peaking procedure we have signal low than **Max signal level(db)** antenna controller will continue peaking procedure. This parameter in normal conditions must be about 11-12 db.

Figure 1.1.2.4 - Signal settings

After adjust any settings user must press button save for apply new settings in the system.

1.1.3 Motors settings

For open **Motors settings** press **Settings->Motors settings**. Using motors settings user can adjust speed of rotation elevation and azimuth motors and maximum motors currens.

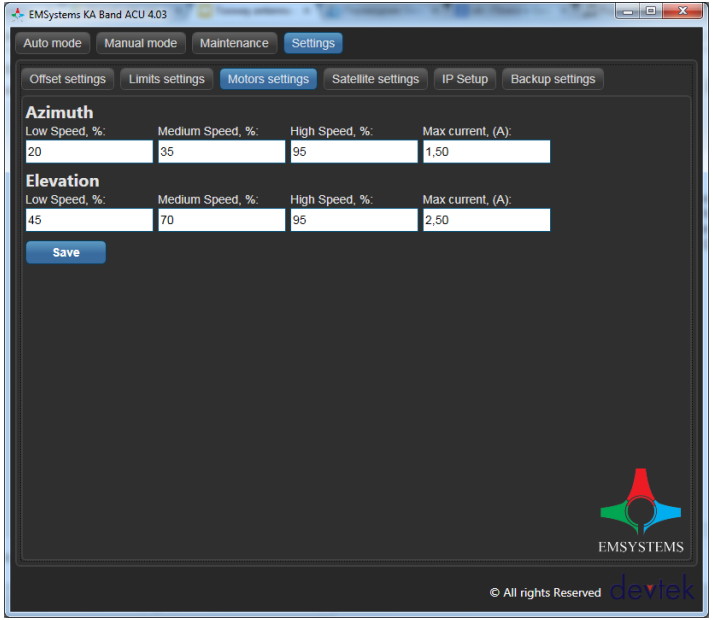


Figure 1.1.3.1 - Motors settings

During antenna rotation, antenna controller switch speed of motors between **Low**, **Med** and **High** speed.
Low speed - low speed of motor rotation. For azimut it must be about 15-20%, for elevation motor it must be about 40-45%.
Medium speed - medium speed of motor rotation. For azimuth motor it must be about 30-35%,or elevation motor it must be about 60-70%.
High speed - high speed of motor rotation. For azimuth motor it must be about 90-100%, or elevation motor it must be about 90-100%.

Max current - maximum current than take motor. Using this parameter, user can set max current for each motor. When motor current will be more than set, antenna controller will stop rotation. It is protection mechanism.

After adjust any settings user must press button save for apply new settings in the system.

1.1.4 Satellite settings

For open **Satellite settings,** press **Settings->Satellite settings**. Using **Satellite settings** user can adjust satellite parameters.

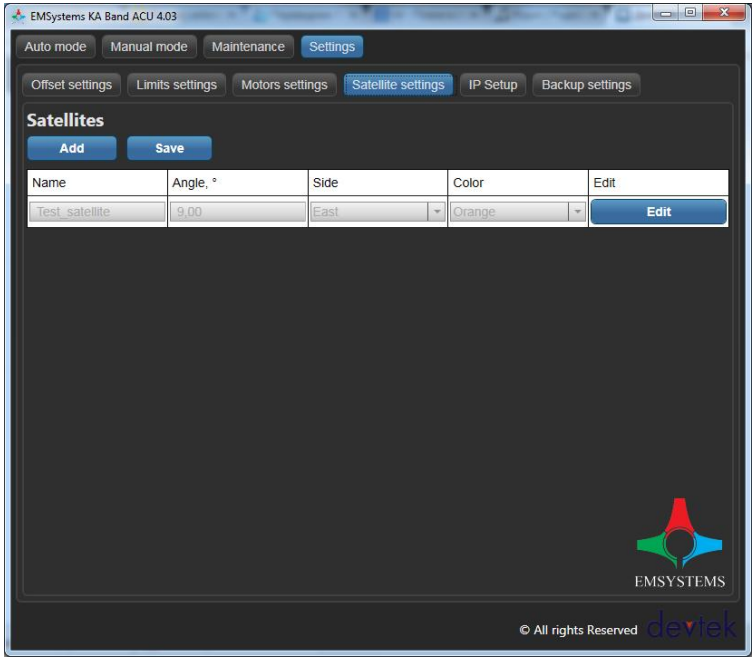


Figure 1.1.4.1 - Satellite settings

In system we have only one satellite. Press button **Edit** and put satellite parameters:
Name - name of satellite;
Angle - angle of satellite;
Side - side of satellite (east or west)
Color - beam color of satellite (depends form place)

After adjust any settings user must press button save for apply new settings in the system.

1.1.5 IP setup

For open **IP settings** press **Settings->IP Setup**. Using this settings user can chandge ip settings of antenna controller, ip address of tooway modem.

IP Address,Mask, Gateway - ip setup of antenna controller.
Antenna controller have default ip setup:

Ip addr	192.168.011
Mask	255.255.255.0
Gateway	192.168.0.1

Port - modbus TCP port. Default value - 502.

Ip Receiver - ip address of tooway modem. Default - 192.168.100.1

After change any settings user must press button save for apply new settings in the system.

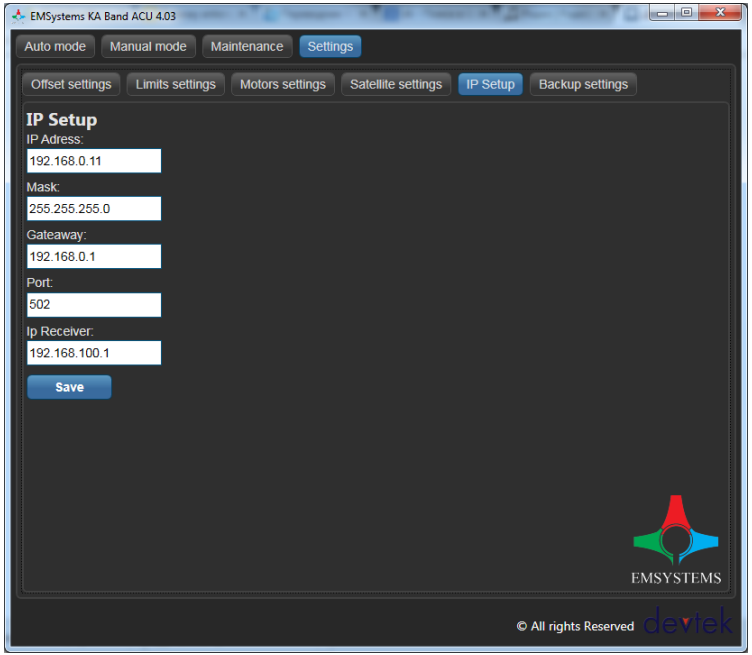


Figure 1.1.5.1 - IP settings

1.1.6 Backup settings

For open **Backup settings** press **Settings->Backup settings**. Using **Backup settings** user can save all system settings or restore all system. settings.

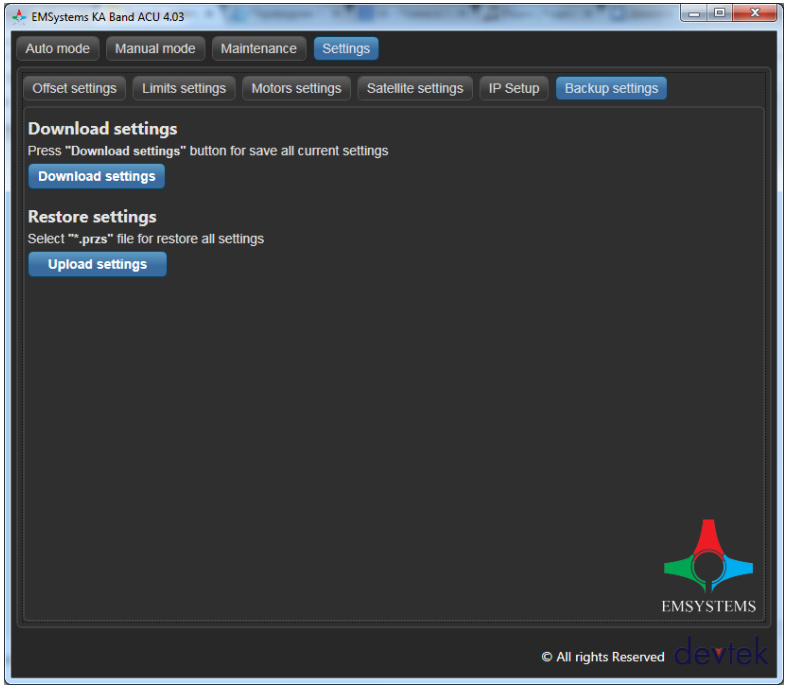


Figure 1.1.6.1 - Backup settings

For create file with all system settings user need press button **Download setting** and save settings file on the pc.
For restore all system settings user need press button **Upload settings** and select file with system settings.
Files with system settings have extension *.**przs**.

1.2. Maintenance overview

1.2.1 Firmware update

For open **Firmware update** page click **Maintenance->Firmware update**. **Fw update** page use for update system firmware.

In field **Firmware version,** user can see current firmware version. For update fw, user must press button **Load firmware** and in open dialog window select file with new firmware. Files with firmware have extension *.**mfw**. During fw update user can see progress of update process. After end of procedure user can see result of procedure.

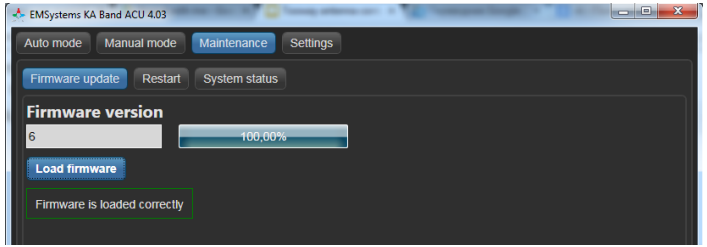


Figure1. 2.1.2 - Firmware load results

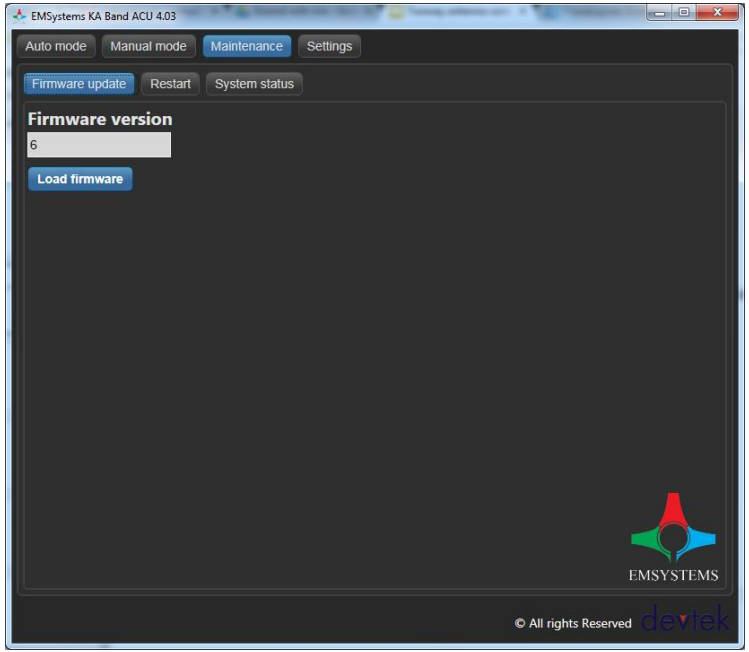


Figure 1.2.1.1 - Firmware update page

1.2.2 Restart

For open **Restart page**, press **Maintenance->Restart**. Using this page user can make restart of antenna controller system.
For make restart, user must press button **Restart**. After few seconds system will restart and will be ready for continue working. During restart user can see progress bar. After finish restart operation, user can see result of operation .

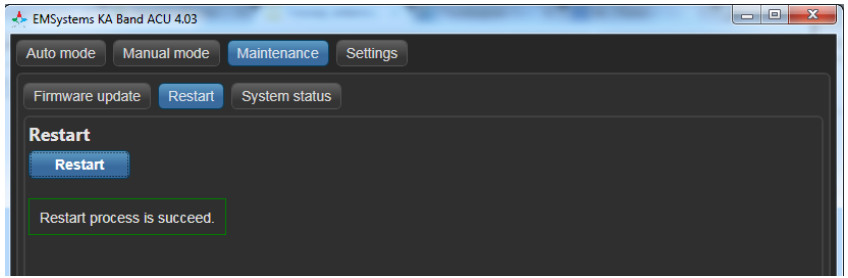


Figure 1.2.2.2 - Result of restart operation

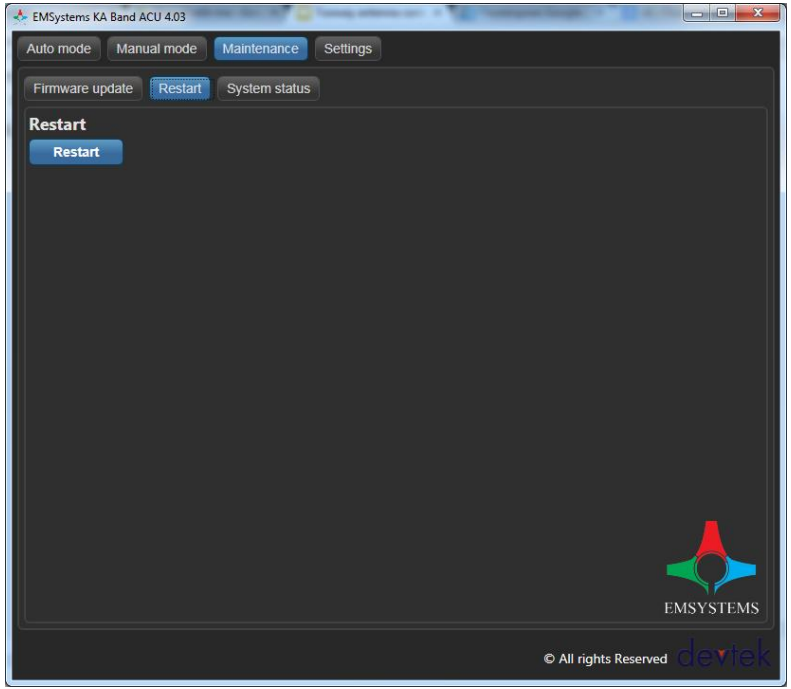


Figure 1.2.2.1 - Restart page

1.2.3 System status

For open **System status** page click **Maintenance->System status**. Using this page user can control state of all system.

Communication status field show state main devices in system (GPS, Compass, Battery, Modem). Using this field user can easily check state of all system. If system have some errors in fields **See all errors** user can find description of errors.

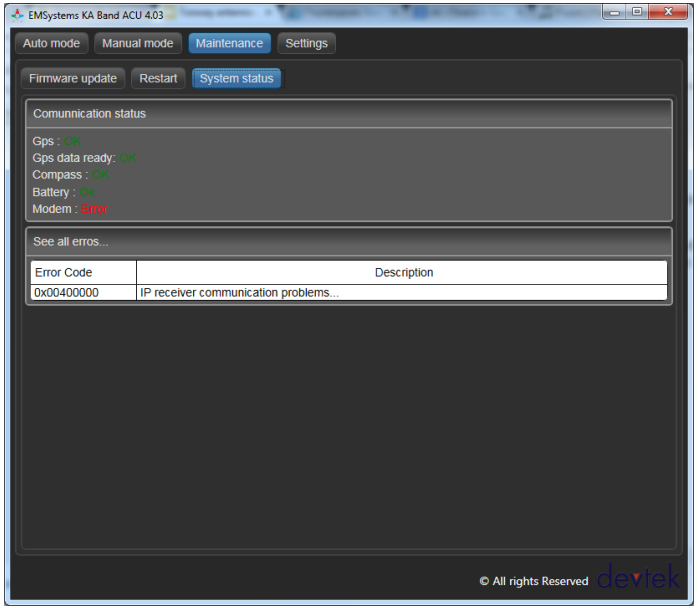


Figure 1.2.3.1 - System status page

Table 2.3.1 List of system errors

Error code	Error group	Description	Explanation
0x000000001	Flash memory errors	Cannot mount flash disc...	Errors in file system. The reason may be a fault in the chip of flash memory.
0x000000002		Low flash disk space...	Free space of flash memory not enough for placing all necessary system settings. The reason may be a fault in the chip of flash memory or soldering not correct flash memory chip.
0x000000004		Cannot format flash disc...	Errors in file system. The reason may be a fault in the chip of flash memory.
0x000000008	Interface settings file errors	Server settings file was created default...	Server settings file created by default settings. Can be set after run new web server board, or if this file have crc errors or if flash memory ic was changed.
0x000000010		Cannot create server settings file...	Some problems with file system. The reason may be a fault in the chip of flash memory.
0x000000020		Server settings file crc error...	CRC error of file. The reason may be a fault in the chip of flash memory or not correct save/read operations.
0x000000040		Cannot open server settings file...	Some problems with file system. The reason may be a fault in the chip of flash memory.
0x000000080	ACU settings file errors	Antenna settings file was created default...	ACU settings file(all ACU settings) created by default settings. Can be set after run new web server board, or if this file have crc errors or if flash memory ic was changed.
0x000000100		Cannot create antenna settings file...	Some problems with file system. The reason may be a fault in the chip of flash memory.
0x000000200		Antenna settings file crc error...	CRC error of file. The reason may be a fault in the chip of flash memory or not correct save/read operations.
0x000000400		Cannot open antenna settings file...	Some problems with file system. The reason may be a fault in the chip of flash memory.

Error code	Error group	Description	Explanation
0x000000800	Satellite table file errors	Satellite table file was created default...	Satellite settings file(all satellite table) created by default settings. Can be set after run new web server board, or if this file have crc errors or if flash memory ic was changed.
0x000001000		Cannot create satellite table file...	Some problems with file system. The reason may be a fault in the chip of flash memory.
0x000002000		Satellite table file crc error...	CRC error of file. The reason may be a fault in the chip of flash memory or not correct save/read operations.
0x000004000		Cannot open satellite table file...	Some problems with file system. The reason may be a fault in the chip of flash memory.
0x000008000	Backup settings file crc errors	Backup settings file was created default...	Backup settings file created by default settings. Can be set after run new web server board, or if this file have crc errors or if flash memory ic was changed.
0x000010000		Cannot create backup settings file...	Some problems with file system. The reason may be a fault in the chip of flash memory.
0x000020000		Backup settings file crc error...	CRC error of file. The reason may be a fault in the chip of flash memory or not correct save/read operations.
0x000040000		Cannot open backup settings file...	Some problems with file system. The reason may be a fault in the chip of flash memory.
0x000080000	Communication errors	Compass not connected...	No communication with compass.
0x000200000		GPS data not ready yet...	GPS data not ready. GPS need some time for synchronization with satellites.
0x000400000		IP receiver communication problems...	Some problems with IP receiver communications. The reason may be not connected ip receiver or broken cables.
0x000800000		Battery is low...	Battery is low. Need change battery.

1.3. Auto and manual motion controls overview

1.3.1 Manual motion controls

Manual motion controls page have different controls for manual antenna rotation and display current state of antenna.

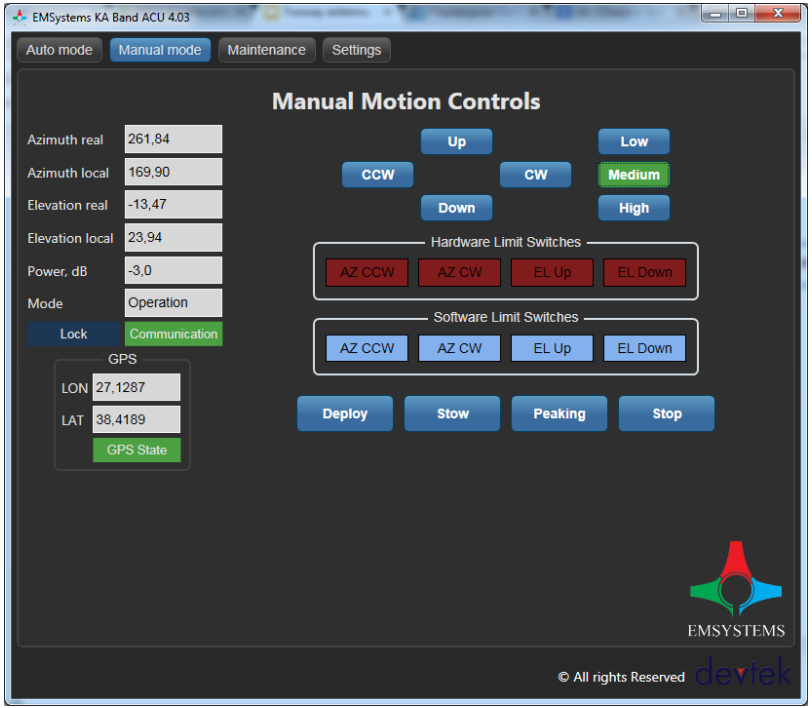


Figure 1.3.1.1 - Manual motion controls page

For manual elevation and azimuth motors controls user can find on this page buttons **UP, Down, CCW, CW**. This button rotate antenna in the appropriate direction.
Using buttons **Low, Med, High** user can switch speed of manual motors rotation.

Figure 1.3.1.2 - Manual antenna control buttons

Antenna controller system have 4 hardware and 4 software limits switches.

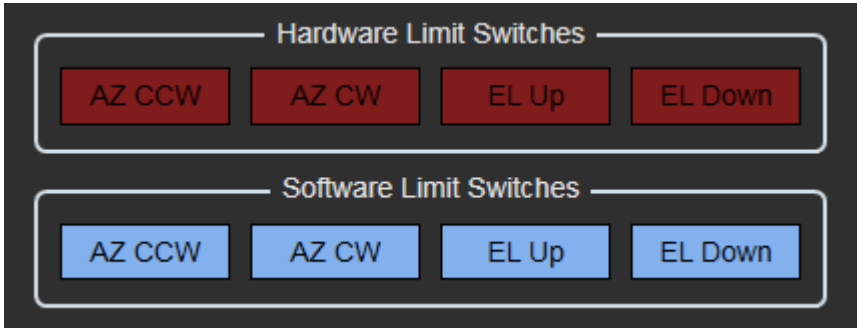


Figure 1.3.1.3 - Antenna limits switches

Switch use for display critical position of antenna. Switch can be active(read color) or inactive(blue color).
AZ CCW hard limit - become active when azimut press **AZ CCW hard switch**. When this limit is active antenna controller cannot rotate azimut in **counter clockwise** direction in manual or auto mode.
AZ CCW soft limit - have the same behavior like **AZ CCW** hard limit but this limit will be active if **Azimut local angle** more or equival to **AZ max CCW angle**.
AZ CW soft and **hard limits** working the same like **AZ CCW hard** and **soft limits**.

EL Up hard limit - become active when elevation press **Up hard switch**. When this limit is active antenna controller cannot rotate elevation in **UP** direction in manual or auto mode.
EL Up soft limit - have the same behavior like **EL Up hard limit** but this limit will be active if **Elevation local angle** more or equival to **EL max UP angle**.
EL Down soft and **hard limits** working the same like **EL UP hard** and **soft limits**.

Manual motion controls page also have buttons **Deploy, Stow, Peaking, Stop**.

Figure 1.3.1.4 - Antenna controls buttons

Stow button will make automatic close of antenna in **stow position**. In **stow position** azimuth local coordinate is 1**80 degrees** and elevation position is about **-60 degrees**. When antenna in stow position user can change location of the system.

Deploy button will make automatic open of antenna in **deploy position**. In **deploy position** azimuth local coordinate is 1**80 degrees** and elevation position is equal to **elevation deploy**(**settings->limits settings**) or more.

Peking button make start of **peaking operation**.
Stop button will make stop of any antenna rotation.

Manual motion controls fields for display current coordinates of elevation and azimuth.
Field **Power, db** display signal level from satellite.
Field **Mode** display current antenna controller state.
ACU have such state:

1. Operation - ACU ready for execute user command.
2. Positioning - ACU rotate azimuth and elevation motors for tune to satellite.
3. Searching - ACU rotate azimuth and elevation motors for find satellite.
4. Peaking - ACU adjust azimuth and elevation for receive best signal from satellite.

Indicator **Lock** using for indicate positive signal from satellite. If **Power, db** more than 0, **Lock** indicator will be **green**. It mean than system find satellite.

Indicator **Communication** using for indicate communication state between ACU software and hardware. When communication between ACU software and hardware is ok, **Communication** indicator will be **green**.

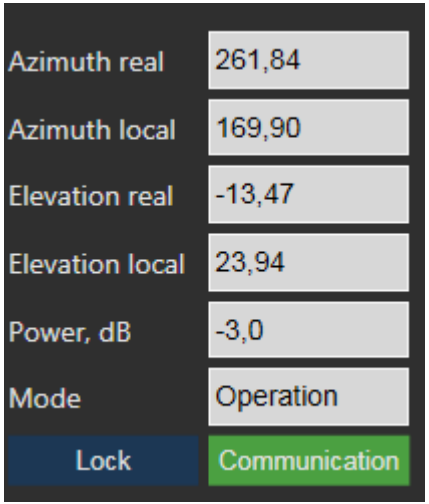
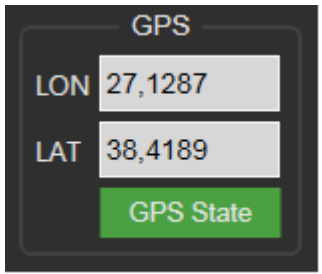


Figure 1.3.1.5 - ACU azimuth and elevation coordinates, power, mode state



Indicator **GPS state** show state of gps. If **GPS state** green it mean than GPS is ready and get coordinates. If GPS state is red, it mean than GPS not synchronize with satellite. After some time GPS will be ready.

Also on Manual motion controls page user can find fields with GPS coordinates.

Figure 3.1.6 - GPS informations

1.3.2 Auto motion controls

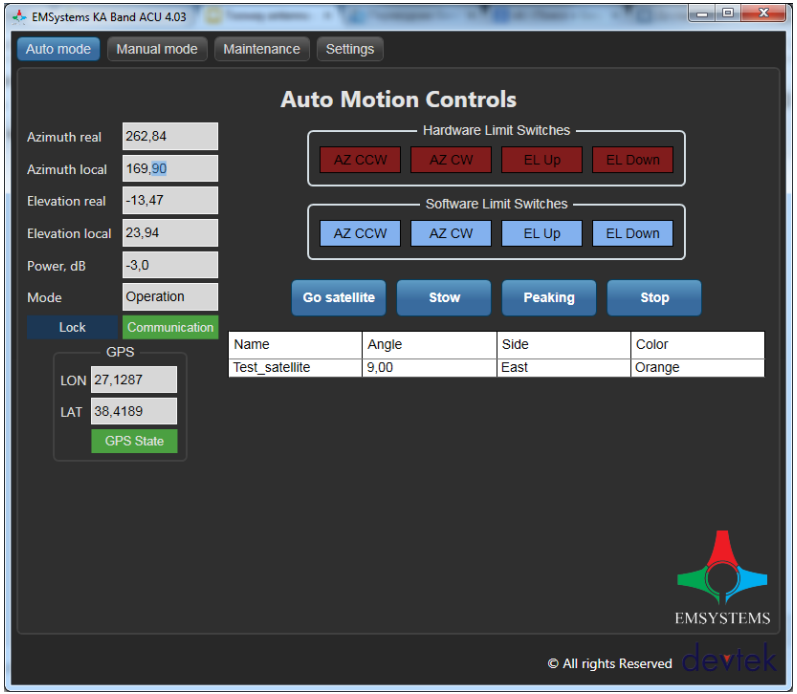


Figure 1.3.2.1 - Auto motion controls page

Auto motion controls page very similar to **Manual motion control** page. On this page user can find table with parameter of satellite.
Button **Go satellite** use for automatic satellite searching. ACU will make positioning, searching and peaking operations.

2. Antenna controller unit usage

This chapter make overview of main operations with antenna controller unit.

2.1 Offset settings adjustment

Before start searching of satellite system settings must be correct. It is very important. At first need check **azimuth and elevation local angles** and **offsets**.
Set **azimut in the center of antenna**. **Azimut local angle** must be **180 +/- 0.2 degrees**. If angle not correct, go to **settings->offset settings** and adjust **azimuth offset** until **azimut local angle** not equal to **180 degrees**. After move **Elevation down** until not press **elevation down hard switch**(this switch must become red). On this steep of antenna controller unit configuration, **software limits** may interfere reach the hard limits. In this case user can change software limits for complete this step of configuration(**AZ max CW angle,AZ max CCW angle, EL max UP angle,EL max Down angle**). After this step try manual control azimuth and elevation(open, close antenna manually, rotate azimut) to ensure that offsets are configured correctly.

2.2 Limits settings adjustment

On this step we need adjust **AZ max CW angle,AZ max CCW angle, EL max UP angle,EL max Down angle.** At first sent azimuth in center of antenna. Than start rotate elevation down until not press hardware down elevation limit. After this go to **settings->limits settings** and set **EL max Down angle.** It must be **more** than current **elevation local angle** on 0.5 degrees. For example, if antenna close and we press **hardware el down switch** and elevation local angle is -60 degrees, so set **EL max Down angle to -59.5** degrees.

After this rotate elevation up until not press **hardware elevation up switch**. Go to **settings->limits** settings and set **EL max UP angle**. This angle must be **low** than current **elevation local angle** on 0.5 degrees. Make the same actions for azimuth(**set AZ max CW angle and AZ max CCW angle**). **AZ max CW angle** must be low than 360 degrees and **AZ max CCW angle** must be more than 0 degrees.

2.3 Inclinometer calibration

For have more realistic angle from inclinometer we need make calibration. For calibration, inclinometer should not be rigidly fastened to the body of the antenna.

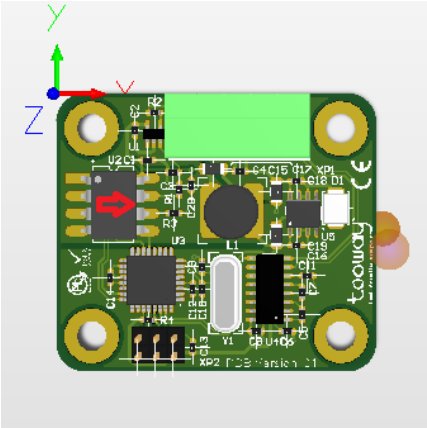


Figure 2.3.1 - Inclinometer board

For calibrations go to **settings->offset settings,** take inclinometer board in the hands, press button **Calibrate inclinometer** and make rotation of board like on the figure 2.3.2

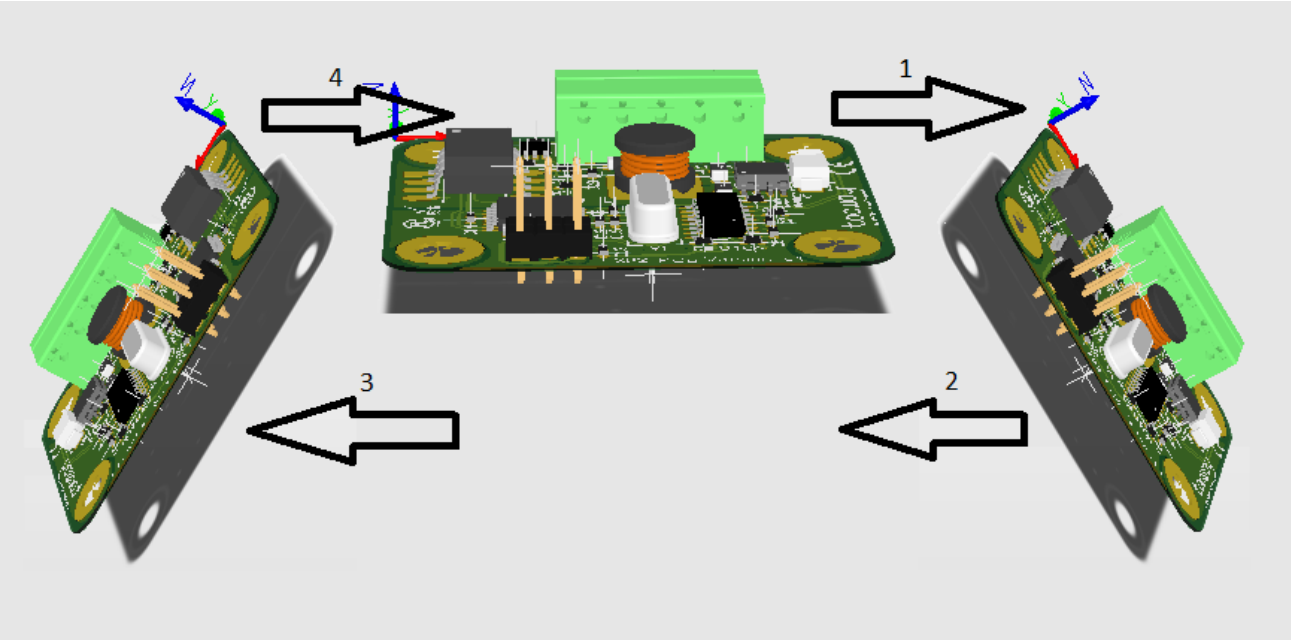


Figure 2.3.2 - Inclinometer calibration

1. Rotate in one side about 70-80 degrees.
2. Return in start position.
3. Rotate in another side about 70-80 degrees.
4. Return in start position.

After this press button **Stop calibrate**.

2.4 Compass calibration

Compass is very sensitive to changing of magnetics field. If near compass place some iron, compass will give some errors in return angle. Because of this we need calibrate compass if we place it in new environment conditions. Calibration will remove errors associated with environmental exposure. Using field compass angle (settings->offset settings) user can check how much greater compass gives an error. For example, now compass angle is 136.3 degrees, we rotate all antenna controller system on 90 degrees clockwise, than we check angle from compass. New angle of compass is 236 degrees. We can calculate 236 - 136.3 = 99,7 degrees. So compass mistake is 9.7 degrees. For correct working of system compass error allowed 10-15 degrees. So user can in any time check compass data.

For calibrate compass, install and fasten compass in the antenna controller system, go to page settings->offset settings and press button **Calibrate compass**. After this start slowly rotate all system one round(360 degrees). After press button **Stop calibrate**. Calibration procedure finished. Now user can check compass angle as described above. If compass angle still have very big mistake - repeat calibration procedure.

2.5 Satellite searching

For satellite searching user need use button **Go satellite** on the **Auto motion Controls** page. On this page user also can see coordinates of satellite.
After press button **Go satellite** antenna controller unit will open antenna in **Deploy** position if antenna was in **stow** position, then antenna controller unit will start positioning of azimuth and elevation. After positioning, searching will start. Searching will work according searching limits settings(settings->limits settings->searching). If antenna will find satellite, antenna controller unit will start peaking operation, else antenna controller unit make all searching steps and stop. User can see signal level of satellite using field **Power, db.** After finish peaking, tooway modem will go in Online mode and user can working with satellite.
After finish working with satellite or change position of system, user need press button **Stow,** antenna controller unit will automatically close antenna in Stow mode.
So, for find satellite user need just press button Go satellite.
Sometimes can be such situation: User press button **Go satellite,** but antenna controller unit not make any rotation. It can be because of :

1. System wait data from GPS, Compass or tooway modem. If GPS data was not ready(GPS state indicator was red) when user press button **Go satellite,** antenna system will wait data from GPS and when GPS receive coordinates antenna system will continue positioning and searching of satellite.
2. Compass not connected. In this case system also will stop rotation of azimuth and elevation and when compass will be connected antenna controller unit will continue positioning and searching of satellite.
3. Tooway modem not connected. System also will wait data from modem and when modem will be connected antenna controller unit will continue positioning and searching of satellite.

All this situations when system not receive data from some device, user can check on **Maintenance->system status** page.
Also during azimuth and elevation rotation, system can reach some hard or soft limits. In this case antenna will stop automatically.